Effects of Implementing a New Management System Model on Organisational Performance

Y K Chan, Phil Gaffney, F K C Tao, L C Koo

Abstract: The MTR Corporation Limited, a metro company in Hing Kong, has developed a new management system model namely the Total Management System (TMS) model since 1998. The new model embedded with TQM philosophy integrates all management systems that can manage the total business of the railway operations. The TMS model was hypothesised with seven constructs based on the common factors of four National Quality Award criteria and critical factors of seven empirical studies. Holistic implementation initiatives were formulated after extensive self-assessment and the TQM implementation instruments of three research studies. The model was successfully implemented in the Operations Engineering Department (OED) as a pilot study and then the Operations Division (OD) subsequently. A questionnaire survey based on a sample of 279 staff members from the OD was conducted to measure the performance in the seven constructs of the TMS model. Structural Equation Modelling (SEM) method was used for model testing. Results of the test indicated that the data generally fitted the model.

With a view to evaluate the effect of TMS implementation on organizational performance, an organizational performance model has been developed. This paper discusses the formulation and testing of this model, which has demonstrated a positive effect of the TMS implementation on the organisational performance in terms of the balanced scorecard (BSC). The causal relationship among five perspectives of the BSC has been verified, bridging the research gap identified by Neely et al. (1995) that there is lack of empirical evidence on the causal linkage among the BSC perspectives.

Keywords: BSC, TMS, AMOS, organizational performance

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1. Objectives of the Organisational Performance Model

Kaplan et al. (1996) describe balanced performance measures as a set of hypotheses about cause and effect. The scorecard makes the relationships (hypotheses) among objectives (measures) in the four perspectives (five in the MTR's balanced scorecard) explicit so that they can be managed and validated. It should portray the cause and effect relationships between outcome measures (i.e. in the financial perspective) and the performance drivers (i.e. in the customer, safety, staff efficiency and process perspectives in the MTR's case). Ultimately, causal paths from all measures on a scorecard should be linked to financial objectives. As pointed out by Koo (1997), there are in fact a priori difficulties in hypothesing the causal linkages in the development stage of a balanced scorecard. Most people tend to use their common sense and past experience in assuming the linkage among the BSC measures. There is no systematic and structural approach to quantifying the strengths of association among the BSC measures. As also indicated by Neely et al. (1995), there is a lack of empirical evidence on the causal linkage of the four perspectives of the BSC. In this research, structural equation modelling by means of AMOS (Arbuckle, 1997) has been employed in testing the organisational performance model. The objectives of this study is two-fold: to test the effect of the TMS implementation on organisational performance in terms of BSC measures, and the casual relationship among the MTR BSC five perspectives (process performance, safety performance, staff efficiency, customer satisfaction and financial performance).

In this research, the organisational performance model is hypothesised by combining all six TMS constructs into one independent variable, which is used to test the effect of TMS implementation on organisational performance (Figure 1). The staff perceptions on the results of the MTR BSC performance become five constructs. The five performance constructs, namely, process performance, safety performance, staff efficiency, customer satisfaction and financial performance are dependent variables.

2. Data Validation

The survey was based on a stratified random sample of 279 among 1116 staff covering all staff at every level across the Operation Division. A total of 261 survey questionnaires in anonymity were returned and the response rate came out to be 94%. The internal consistency test (Nunnally, 1967) indicated that the Cronbach's alpha ratios for all the components of the questionnaire are greater then 0.8, thus the responses within each main component are regarded to be reliable. The item analysis as suggested by Nunnally (1967) concluded that all items in the questionnaire had been appropriately assigned to scales. The confirmatory Factor Analysis with a cutoff loading of

0.55 has reduced the variables from 49 to 31. The reliability and validity analyses concluded that the data obtained through this instrument could be used in subsequent data analysis.

3. Hypotheses of the TMS Implementation and the Five Organisational Performance Constructs

The Operations Division balanced scorecard has become a holistic indication of the organisational performance of the railway operations. Hence, the five hypotheses among five constructs (process performance, safety performance, staff efficiency, customer satisfaction and financial performance) demonstrate the impact of the TMS implementation to each construct of the organisational performance. They are:

Hypothesis P1: *TMS implementation has a positive effect on process performance (Indicators P1, P2 and P3 of Appendix 1)*

Hypothesis P2: *TMS implementation has a positive effect on safety performance (Indicators S1, S2 and S3 of Appendix 1)*

Hypothesis P3: *TMS implementation has a positive effect on staff efficiency (Indicators E1, E2 and E3 of Appendix 1)*

Hypothesis P4: *TMS implementation has a positive effect on customer satisfaction (Indicators C1, C2, C3, C4, C5 and C6 of Appendix 1)*

Hypothesis P5: *TMS implementation has a positive effect on finance performance (Indicators F1, F2, F3 and F4 of Appendix 1)*

4. Hypotheses among the Five Organisational Performance Constructs

The process in the TMS model involves the integration of various system requirements, such as the safety requirements of the operating railway and the environmental requirements as well as those requirements that concern with the core business to achieve business results. Hence, the following hypothesis is proposed:

Hypothesis PA1: *Process performance has a positive impact on safety performance*

A comprehensive study jointly conducted by the American Quality Foundation and the accounting and consultant firm, Ernst & Young (1991) studied the TQM efforts of more than 500 firms in US, Canada, Germany and Japan. They found that among other issues, Process improvement methods have significant impact on customer satisfaction. Thus the following hypothesis is proposed:

Hypothesis PA2: *Process performance has a positive impact on customer satisfaction*

One of the very important features of the TMS design is the establishment of a team-based structure, which aligns all team efforts towards common goals. Providing clear goals and a structured process to achieve them will improve staff work satisfaction and commitment which in turn, will improve staff efficiency and hence, contribute to the business result of the organisation. Anderson et al. (1995) suggest that employee satisfaction has significant effect on customer satisfaction; it is the foundation for an organisation to achieve organisation excellence. Fitzgerald et al. (1991) find that employees' perceptions and attitudes are positively related to customer satisfaction. The research conducted by Anderson et al. (1995) also suggests that satisfied employees will improve efficiency and will also make extra efforts to ensure the success of their firm. Therefore, the following three hypotheses are proposed:

Hypothesis PA3: Staff efficiency has a positive impact on process performance
Hypothesis PA4: Staff efficiency has a positive impact on customer satisfaction
Hypothesis PA5: Staff efficiency has a positive impact on financial performance

Numerous studies have shown that a high level of customer satisfaction is strongly related to firm's financial performance (Naumann and Giel, 1995). Rust and Zahorik (1993) suggest that customer satisfaction has a positive effect on customer retention and profit. They portray customer satisfaction as an important indicator of a firm's financial health. Zairi et al. (1994) suggest that customer satisfaction can lead to an increase in firm's market share and profits. Based on these empirical findings, the following hypothesis is proposed:

Hypothesis PA6: Customer satisfaction has a positive impact on financial performance

Brown (1988) indicates that safety is the most important issue in the railway operations. A good safety performance not only reduces incidents and hence service interruption it also improves competitiveness. A punctual and reliable service has become a single most competitive advantage over other transportation modes such as buses. Therefore, two additional hypotheses are proposed as follows:

Hypothesis PA7: Safety performance has a positive impact on financial performance
Hypothesis PA8: Safety performance has a positive impact on customer performance

5. Formulation of the Theoretical Model

Based on the above 13 hypotheses, a theoretical model of TMS implementation and overall organisational performance is developed, and is displayed in Figure 1:

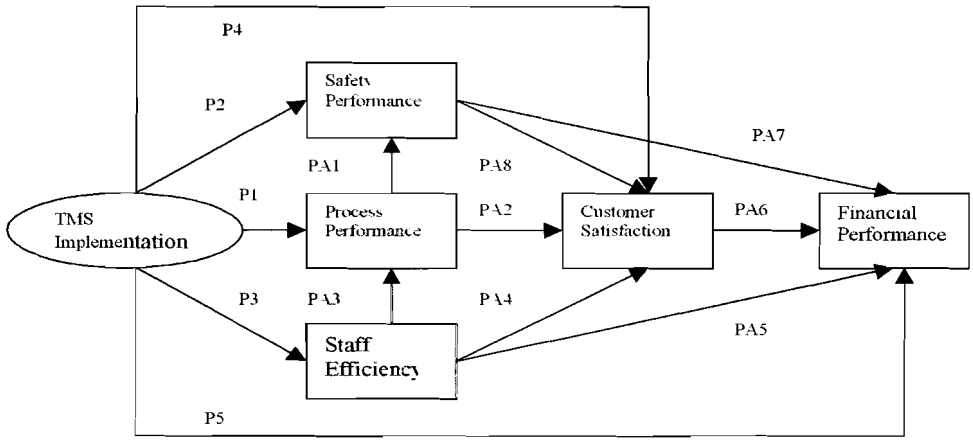


Figure 1

Theoretical Model of TMS Implementation and Overall Organisational Performance

By fitting the Structural Equation Models employing AMOS Version 3.6 (Arbuckle, 1997), the relationships among the TMS, process performance, staff efficiency, safety performance, customer satisfaction and financial performance are revealed as follows:

Effect / Cause	Staff Efficiency	Process Performance	Safety Performance	Customer Satisfaction	Financial Performance
TMS Implementation	Significantly Positive	Significantly Positive	Significantly Positive	Not Significant	Not Significantly
Staff Efficiency	-	Significantly Positive	N.A	Significantly Positive	Significant Positive
Process Performance	N.A.	-	Significantly Positive	Significantly Positive	N.A.
Safety Performance	N.A.	N.A.	-	Significantly Positive	Significantly Positive
Customer Satisfaction	N.A.	N.A.	N.A.	-	Significantly Positive

Note:

1. 'Significantly Positive' represents that the corresponding C.R. in a path is greater than 1.645.
2. 'Not significant' represents that the corresponding C.R. in a path is less than 1.645.
3. 'N.A.' represents that the corresponding path has not been considered.

Table 1

Summary of Relationships among the TMS and the Five Organisational Performance Constructs

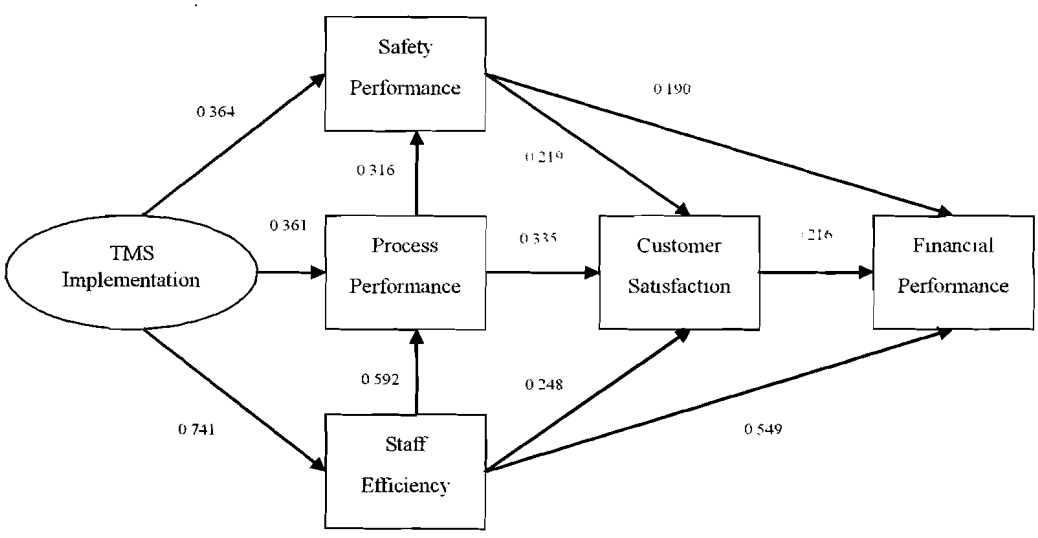
The two insignificant paths indicate that TMS implementation does not directly affect both customer satisfaction and financial performance, but indirectly affect the customer satisfaction and financial performance through staff efficiency, process and safety performances (Figure 1). Deleting these two insignificant paths and refitting the model, the following results have been identified (columns 1 and 2 show the results of the proposed model whist 3 and 4 illustrate the revised one):

Path			Proposed Model		Revised Model	
			Estimate 1	CR 2	Estimate 3	CR 4
Staff Efficiency	←	TMS Implementation	0.741	10.400	0.741	10.399
Process Performance	←	TMS Implementation	0.361	4.439	0.361	4.439
Process Performance	←	Staff Efficiency	0.592	9.398	0.592	9.398
Safety Performance	←	Process Performance	0.316	5.838	0.316	5.838
Safety Performance	←	TMS Implementation	0.364	4.591	0.364	4.591
Customer Satisfaction	←	Process Performance	0.342	5.226	0.335	5.212
Customer Satisfaction	←	Safety Performance	0.226	3.626	0.219	3.655
Customer Satisfaction	←	Staff Efficiency	0.248	3.419	0.248	3.641
Financial Performance	←	Staff Efficiency	0.548	7.961	0.549	8.928
Financial Performance	←	Customer Satisfaction	0.216	3.634	0.216	3.648
Financial Performance	←	Safety Performance	0.186	2.964	0.190	3.210
Financial Performance	←	TMS Implementation	0.012	0.138	Deleted	-
Customer Satisfaction	←	TMS Implementation	-0.023	-0.270	Deleted	-

Table 2

Estimates and CRs of the TMS Implementation and Its Impact to Overall Organisational Performance

In AMOS, relative chi-square is adopted to evaluate the global fit. According to Carmines and Mclver (1981), the relative chi-square should be in the range of 2:1 and 3:1 for an acceptable model. However, Kline (1998) states that a relative chi-square of 3 or less is acceptable. AMOS lists relative chi-squire as CMIN/DF (minimum sample discrepancy/degree of freedom). In this study, the relative chi-square is 1.929 (CMIN = 82.976; DF = 43; CMIN/DF =1.929). The relative chi-square of this study confirms that the data fits the theoretical model of TMS implementation and overall organisational performance. The testing results and the final theoretical Model of TMS implementation and overall organisational performance are illustrated in Figure 2:



Note:

1. Upper figures estimate of path coefficients

2. The figures in the brackets are CRs

Figure 2

Final Theoretical Model of TMS Implementation and Overall Organisational Performance

5. Interpretation of Testing Results

From the results of testing the model of TMS implementation and overall performance, which is based on the survey results of 261 staff members of the Operation Division, it can be concluded that TMS implementation has positive effects on staff efficiency, process performance and safety performance. However, the TMS implementation does not have direct impact on customer satisfaction and financial performance but acts indirectly through staff, process and safety

performances to achieve them. Among the 13 hypotheses, 11 have been statistically confirmed in this study, including hypotheses of the cause and effect relationships of the balance scorecard, which is believed to be the first validation empirically.

6. Summary

With a view to validating the effects of TMS implementation on the overall organisational performance measured by BSC, and the cause and effect relationships among the five BSC perspectives (i.e. staff efficiency, process performance, safety performance, customer satisfaction and financial performance), a theoretical model was hypothesised. The model was tested by structural equation modeling (AMOS version 3.6) and results indicated that the data from 261 staff members of the Operations Division fit the model. Among the 12 hypotheses, 10 are positively significant at 0.01 level. The two insignificant paths demonstrate that TMS implementation does not directly affect the customer satisfaction and financial performance, but indirectly through staff efficiency, process and safety performances. The test results conclude that:

1. TMS implementation has positive impact on staff efficiency, process and safety performances, but does not have direct impact on customer focus and financial performance;
2. Staff efficiency has positive impact on process performance, customer satisfaction and financial results;
3. Process performance has positive impact on safety performance and customer satisfaction;
4. Safety performance has positive impact on customer satisfaction and financial performance; and
5. Customer satisfaction has positive impact on financial performance.

It should be noted that the data used to test the model came from only 261 staff of the Operations Division. It only reflects the perception of the OD staff members on TMS implementation and overall organisational performance. Thus, the research finding might have been biased to a certain degree and might not be very reliable. Using the actual performance data when sufficient number has been accumulated can develop a more reliable model. This will be an opportunity for further study.

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【摘要】 香港地下鐵路有限公司在１９９８年已發展建立了一套新的管理系統模式，它被稱之為全面管理系統（ＴＭＳ）。新的管理系統融合了全面質量管理哲學以及相關的專業管理地鐵業務的管理知識，ＴＭＳ系統以全面質量獎包含的四大標準和重要系數作為前提而設計，ＴＭＳ所有的設計以大規模的自我鑑定和三份有關ＴＱＭ全面實施工具的研究論文指引為基礎。系統先在營運工程部試驗，隨後在營業分流部實施都見有成效。地鐵公司對營業分流部的２７９名員工進行了問卷調查，目的針對ＴＭＳ系統的七項指標的功效進行量度，結構均衡模型（ＳＥＭ）的方法在ＴＭＳ設計過程中一直被用於作試驗工具，最後以試驗結果來指引ＴＭＳ的設計。

透過ＴＭＳ在企業運作的成果，香港地鐵公司以此標準建立了企業行為模式，本論文將討論ＴＭＳ的設計和測試其被廣泛應用真正的可行性。

【關鍵詞】 平衡計分咭、全面管理系統、ＡＭＯＳ、企業績效

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